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Coexistence of U-NII Devices with Fixed Links at 6 GHz

Simulation study to evaluate interference potential to Fixed Links

- Antti Piipponen, Lauri Sormunen, Prakash Moorut

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Overview

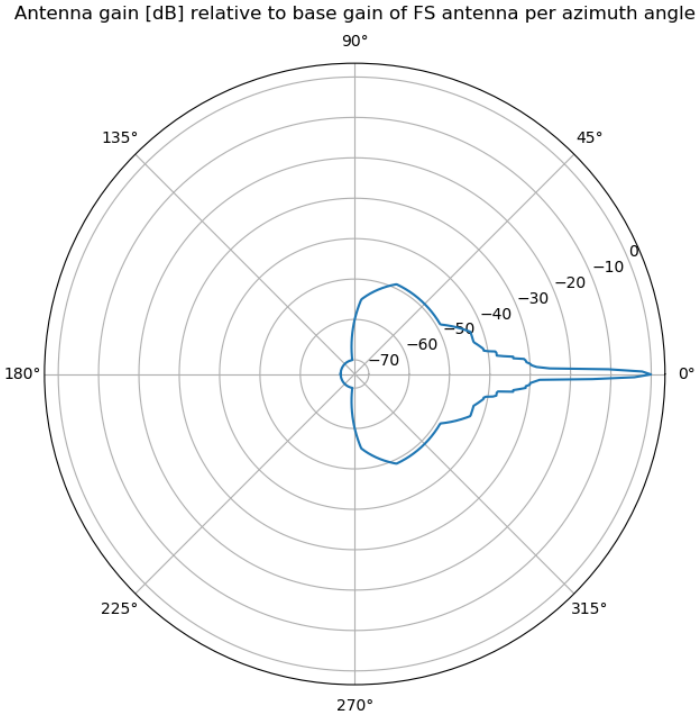
- Coexistence between 6 GHz U-NII network and FS receiver has been studied
- Both co-channel cases and adjacent channel cases are included
- Study focuses on realistic deployments
  - Outdoor U-NII microcell network with FS receiver within the area
  - Indoor office U-NII network with FS receiver on the roof of the building
  - Indoor office U-NII network with FS receiver on the roof of the adjacent building
- Dynamic system simulator is used to evaluate the interference
  - Realistic RF impairments, radio protocol models, etc.
- Potential interference cases are found using the rules in the NPRM
  - Automated Frequency Coordination should avoid co-channel deployment of U-NII and fixed links

Simulation parameters
U-NII devices

- Maximum TX power
  - U-NII outdoor access point: 30 dBm conducted / 36 dBm EIRP
    - 120 degree sector antennas with 6 dBi max gain
  - U-NII indoor access point: 24 dBm conducted
  - U-NII client device: 18 dBm conducted
- U-NII device unwanted emissions (adjacent channel leakage ratio)
  - Access point: 35 dB
  - Client device: 30 dB
- U-NII TDD configuration: 50% uplink, 50% downlink
- U-NII device scheduling: Single device within cell transmitting at a time
- U-NII device channel bandwidth: 20 MHz

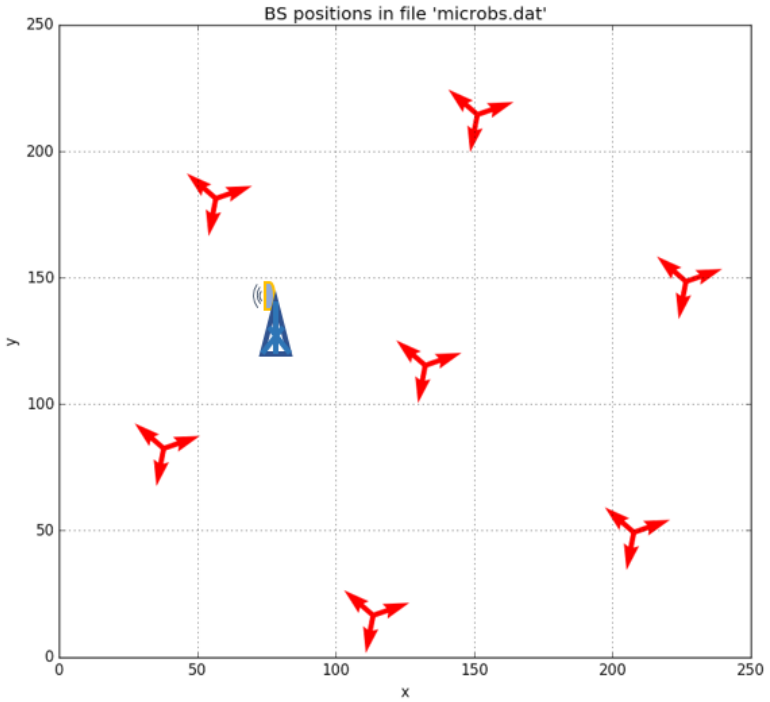
Simulation parameters
Fixed link receiver

- Antenna
  - Size: 12.0 ft / 3.6 m dish
  - Max gain: 45.1 dBi
  - 3 dB beam width: 0.9 degrees
  - Gain at ≥100 degrees from main beam: -25 dBi
  - Downtilt: 0 degrees
- Receiver noise figure: 4 dB
- Receiver duty cycle: 100%
- Channel bandwidth: 10 MHz (FDD receive channel)



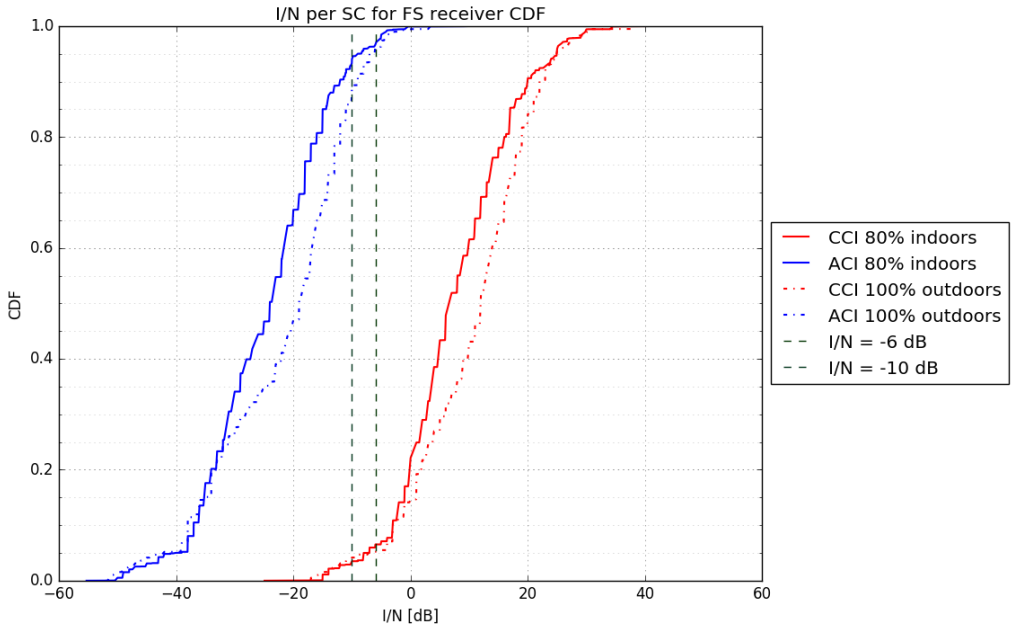
Scenario 1 parameters
Outdoor U-NII microcell network

- 7 sites with 3 sectors each (21 cells) with wraparound
- FS receiver placed at random location and azimuth
- 100 m inter-site distance
- 5 UEs per cell
  - Case a: 20% outdoor, 80% indoor
  - Case b: 100% outoor
- Access point height: 10 m
- FS receiver height: 15 to 115 m



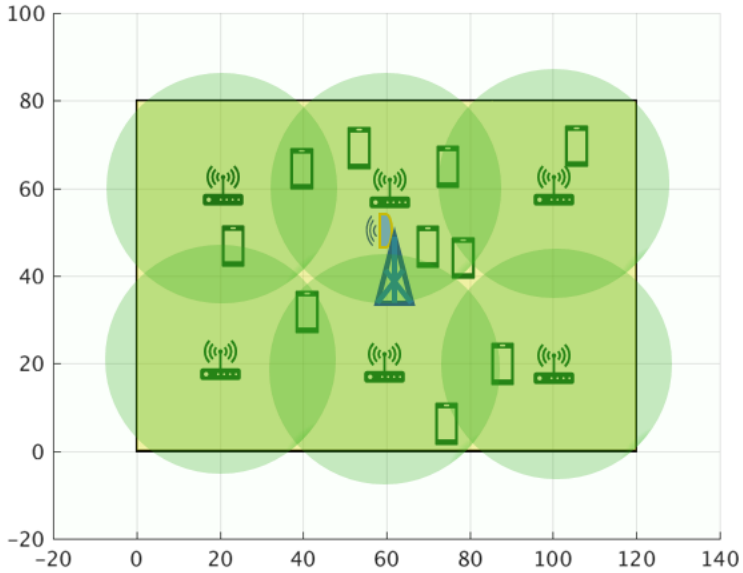
Scenario 1 results
Outdoor U-NII microcell network

- Results presented for:
  - Overlapping channels (CCI, red)
  - Adjacent channels (ACI, blue)
  - U-NII devices 20% outdoor (solid)
  - U-NII devices 100% outdoor (dashed)
- Co-channel deployment is not feasible
- Adjacent channel deployment exceeds -10 or -6 dB I/N ratio about 3%…10% of the time
- Dish antenna gain at negative elevations is a key parameter that affects interference potential



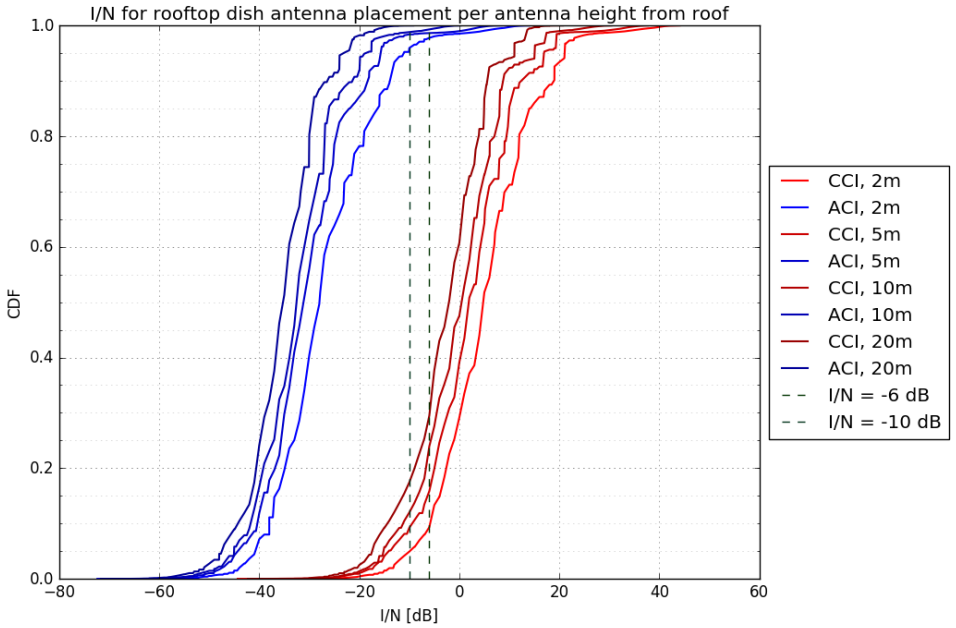
Scenario 2 parameters
Indoor U-NII network + rooftop FS receiver

- Model of the office building top floor indoor deployment
- FS receiver placed at the center of the roof at different height mast (2 m to 20 m)
- 6 indoor cells, ceiling mounted
- 5 UEs per cell (30 total)



Scenario 2 results
Indoor U-NII + rooftop FS receiver

- Results presented for:
  - Overlapping channels (CCI, red)
  - Adjacent channels (ACI, blue)
  - Different FS mast heights
- Co-channel deployment is not feasible
- Adjacent channel deployment exceeds -10 or -6 dB I/N ratio about 3%...4% of the time
- Ceiling penetration loss and dish antenna gain at negative elevations are key parameters that affect interference potential



Building wall penetration loss according to 3GPP TR 38.901

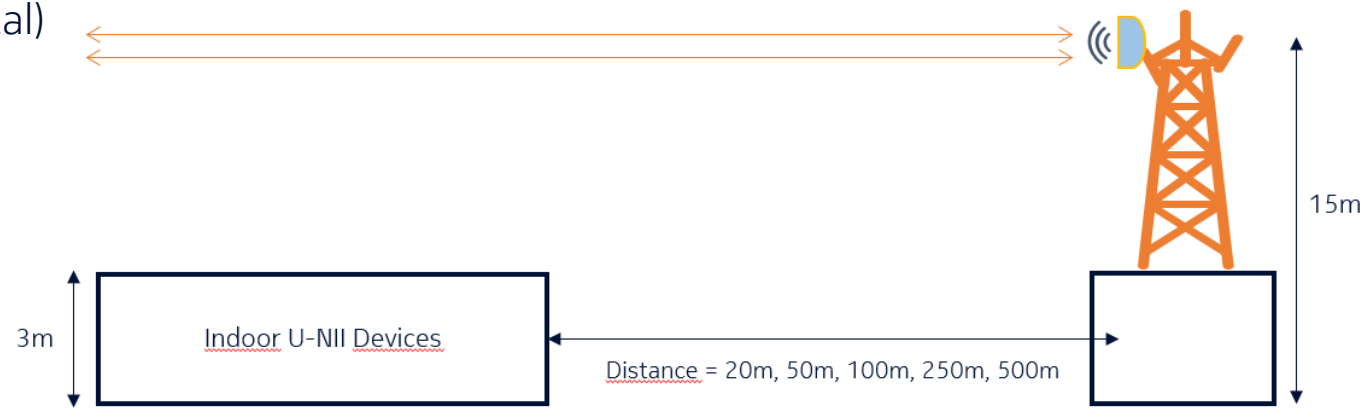
- Low-loss materials: 13.4 dB @6GHz (50% probability)
- High-loss materials: 30.7 dB @6GHz (50% probability)

Ceiling penetration loss uses the same model

Scenario 3 parameters

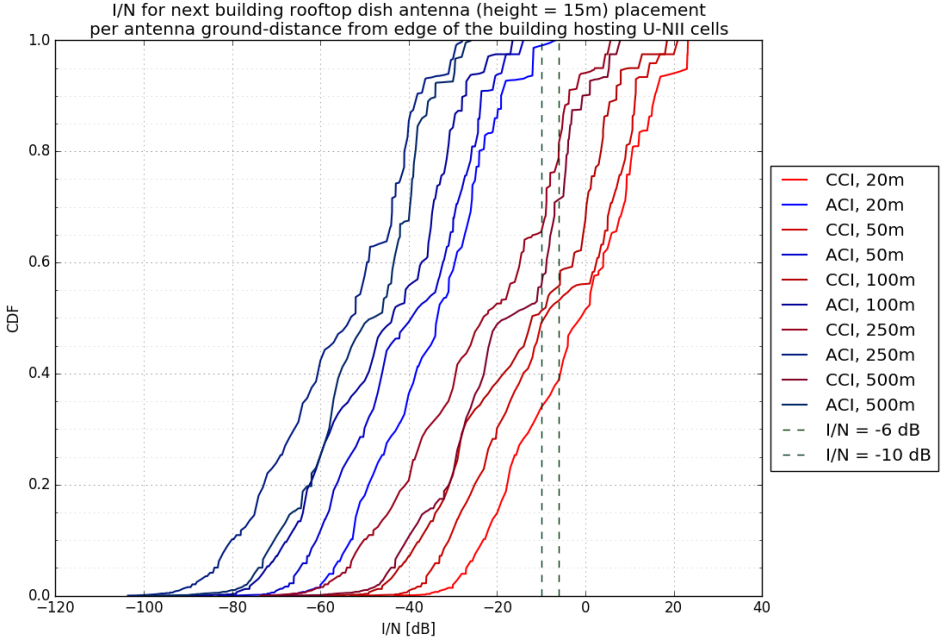
Indoor U-NII network + adjacent building rooftop FS receiver

- Model of the office building indoor deployment (same as in scenario 2)
- FS receiver placed at the rooftop of another building, with main beam azimuth towards the U-NII devices
- FS receiver distance from U-NII devices varied from 20 m to 500 m
- 6 indoor cells, ceiling mounted (at 3 m height); FS antenna height 15 m
- 5 UEs per cell (30 total)



Scenario 3 results
Indoor U-NII + adjacent building FS

- Results presented for:
  - Overlapping channels (CCI, red)
  - Adjacent channels (ACI, blue)
  - Different FS distances
- Co-channel deployment is not feasible
- Adjacent channel deployment exceeds -10 dB I/N in some cases
- Wall penetration loss has significant impact on the interference



Building wall penetration loss according to 3GPP TR 38.901

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- High-loss materials: 30.7 dB @6GHz (50% probability)

Summary

- Coexistence simulation results for realistic deployments of U-NII devices and Fixed Link receivers were presented
- For outdoor U-NII devices, co-channel deployment with FS is not feasible
- For indoor U-NII devices, co-channel deployment deserves further studies
- For all simulated scenarios and parameters, adjacent channel deployment is feasible
  - However, FS receiver selectivity has not been considered in the simulations and warrants further study. A guard band could potentially be needed between FS and U-NII spectrum blocks that the AFC needs to take into account.

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